

lands has gone on at the present rate. The phenomenon has been approximately the same for 6,000 years, but during the Bronze Age and just after, it was possibly slower. The more ancient phenomena are difficult to discuss, as a damming up of the Baltic outlet would produce results similar to actual land elevation.—*W. A. Richardson*.

THE WAVE-RAISING POWER OF NORTHWEST AND SOUTH WINDS COMPARED.¹

I recall that sailors on the Great Lakes have claimed that a wind of a given velocity in winter caused a higher

¹ Cf. February, 1920, issue MONTHLY WEATHER REVIEW, pp. 100-101.

DISCREPANCIES BETWEEN ÅNGSTRÖM AND SMITHSONIAN INSTRUMENTS.

By C. G. ABBOT, Director, Astrophysical Observatory.

[Smithsonian Institution, Washington, May 3, 1920.]

In the issue of the MONTHLY WEATHER REVIEW for November, 1919, Dr. A. K. Ångström has three papers of great interest. In one paper he gives comparisons which must be highly gratifying to all those who are interested in the constancy of the scale of radiation measurements. He shows that in the seven years, 1912 to 1919, there had occurred no appreciable change in the Ångström and Smithsonian scales relatively to each other. During this interval Smithsonian observers have made several unpublished comparisons against the Standard water-flow pyrheliometer No. 3, which also supported the constancy of the Smithsonian scale with very satisfactory accuracy of experimentation. Thus we may be sure, it seems to me, that no change in the scales on which pyrheliometric and spectrophotometric measurements have been made for many years has occurred so large as 1 per cent.

Dr. Ångström finds the Smithsonian scale to be 3.2 per cent above the Ångström scale. Of this discrepancy, he admits that 1.8 per cent is due to the two small sources of error which he discussed in a former publication. The other 1.5 per cent he is inclined to throw upon the Smithsonian scale.

In regard to this latter suggestion, I am only able to say as was said in Volume III of the *Annals*: "The system which we call 'Smithsonian Revised Pyrheliometry of 1913' rests on 72 comparisons on 20 different days of 3 different years with 3 standard pyrheliometers of different dimensions and 2 widely different principles of measurement, all capable of recovering and measuring within 1 per cent test quantities of heat, and all closely approximating to the 'absolutely black body.' The 72 comparisons, 40 at Washington, 32 at Mount Wilson, were made in 6 groups. The maximum divergence of the mean results of these groups is 1 per cent. Hence it is believed that the mean result of all the comparisons made under such diverse circumstances must be within 0.5 per cent of the truth. The probable error is 0.1 per cent. It is believed that this standard scale is reproducible by the secondary pyrheliometers with the adopted constants given to within 0.5 per cent."

In Volume III of the *Annals* the determination of the constants of the Standard pyrheliometers Nos. 2, 3, and 4, and the comparisons which have been made with them, are given with great detail from pages 55 to 72, so that readers will be able to see for themselves at every step how far the claim just quoted is justified.

It appears to me that before we can be warranted in admitting Dr. Ångström's suggestion that the Smithsonian scale is 1.5 per cent in error because it exhibits

sea than a wind of the same velocity in summer. They attributed this to the fact that in summer the relatively cold water of the Lakes reduced the temperature of the surface air layers, producing a temperature inversion. As a result, a wind movement in the upper air layers, which might be strong at the height of the masthead, would be light at the surface of the water. In winter, on the contrary, the air is generally colder than the water of the Lakes, the air movement is felt down to the surface and causes high seas.

Perhaps a similar explanation may apply to the difference in wave-raising power of northwest and south winds, since in the northern hemisphere the former are apt to be the colder.—*H. H. Kimball*.

that degree of divergence from the corrected Ångström scale, we ought to have equally full details of measurements and comparisons on which the Ångström scale and comparison between it and the Smithsonian scale rest.

Especially I would call attention to these points:

1. Since the electrical resistance of the Ångström strips in the standard instruments is measured by a potentiometer device between points of known distance apart it would be possible, by making the Wheatstone's bridge measurement of the actual resistance between the terminals of the Ångström strips, to determine the actual distance through which the heating of the strip occurred rather than to make an estimation with regard to that distance, as was done by Dr. Ångström in his experiments which led him to the correction of 1.3 per cent.¹ This is very important, for he will agree that the mathematical theory of the subject shows that if the difference in length between the sun-heated and electrically-heated portions of the strip should be above his estimate of it the magnitude of the correction would very rapidly grow.

2. Since the width of the strip is only 2 mm., accuracy to 0.5 per cent demands that the width should be known to within 0.01 mm. In view of the presence of the particles of platinum black and of soot required for blackening the strips, is it possible to define the edges of the strips to within this degree of accuracy? Dr. Knut Ångström,² the distinguished inventor of the instrument, states with regard to this point: "Since the coating with lampblack leaves the edges a trifle rough, an error of 0.01 mm. in measures of the width evidently can not be avoided, which in the width of the strips here used may make an error of 0.5 per cent in the final value."

3. Although the measurements of Kurlbaum indicate that the effect of introducing the heat at the front of the strip when heated by the sun, as against introducing it through the body of the strip when heated by the current, produces but a small amount of error, is it quite certain that the blackening Dr. Kurlbaum experimented with is so nearly similar to the blackening of the Ångström strips that this correction is as small for the Ångström pyrheliometer as for the Kurlbaum metal foil? Dr. Ångström's computations lead him to admit 0.5 per cent for this effect. But the magnitude of it must depend on the intimacy of contact between each individual strip and its blackening. Is this known to be uniform and that negligible opposition to the flow of heat occurs

¹ *Astroph. Jour.*, vol. 40, p. 279. It is by no means certain that the ends of the strips electrically were at the edges of the pole pieces visually.

² *Astroph. Jour.*, vol. 9, p. 336.